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MODEL 45

4 DIGIT

ULTIMETER

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DATA TECHNOLOGY
CORPORATION
U.S.A.

The Racal Millivoltmeter Model 9079 is manufactured for Racal by the Data Technology Corporation of California. Technical specifications and mechanical construction details of this instrument are similar to the Data Technology Model 45 Millivoltmeter.

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MODEL 45

4-DIGIT MULTIMETER

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SECTION I

GENERAL DESCRIPTION AND SPECIFICATIONS

1-1. GENERAL

1-2. The Model 45 is a 4-digit digital multimeter (DMM). The measurement functions are dc voltage, ac voltage, dc current, ac current, and ohms. All measurement functions have five ranges except ohms which has six. The range limits are set at ±12000 counts. The MSD display flashes for readings above 9999 counts.

1-3. BATTERY/CHARGER OPTIONS

1-4. The Model 45 is available with or without batteries, and functions in any of the following modes:

Battery only
Battery and charger
Charger only; batteries removed
Unit OFF; batteries charging

1-5. The unit also functions using any of the large variety of "D" size batteries available, however, only nickel cadmium batteries are rechargeable. The life of substitute batteries must be calculated, based upon the 360 milliampere current drain.

1-6. CHARGER OPTIONS

1-7. Chargers are available for operation from three power sources — 115, 100, and 230 volts rms, 50 to 60 hertz.

1-8. OPTIONAL IC SOCKETS

1-9. The user is afforded greater ease of repair when an assembly is specified with IC sockets. When this option is not specified, the IC's are soldered directly to the printed circuit board.

1-10. OPTIONAL SPARES AND ACCESSORIES

1-11. Table 1-2 shows a list of spares and accessories for the Model 45.

Table 1-1. Model 45 Assemblies

Assembly Number	Batteries (4)	IC Sockets	Main Power
548900-102			115Vrms
548900-103			100Vrms
548900-104			230Vrms
548900-105		X	115Vrms
548900-106		X	100Vrms
548900-107		X	230Vrms
548900-108	X		115Vrms
548900-109	X		100Vrms
548900-110	X		230Vrms
548900-111	X	X	115Vrms
548900-112	X	X	100Vrms
548900-113	X	X	230Vrms

1-12. SPECIAL MODIFICATIONS

1-13. The units which are modified to customer's special requirements do not reflect an assembly number as specified in Table 1-1. For details on special modifications, see Section V.

Table 1-2. Accessories and Spares

Assembly Number	Description
532062-001	Universal Test Lead Kit
548954-100	Carrying Case
532051-003	Battery (need 4)
548900-203	Battery Module w/o Batteries
532121-001	115V rms Battery Charger
532121-002	230V rms Battery Charger
532121-003	100V rms Battery Charger
532104-100	High Voltage Probe
549257-100	RF Probe
532103-100	Demodulation Probe
548829-001	Rack Mount (single unit)
548830-001	Rack Mount (side-by-side)
548912-001	Manual

1-14. SPECIFICATIONS

1-15. See Table 1-3.

Table 1-3. Specifications

GENERAL	
Environment	
Operating Temperature Range	
w/Batteries	0 — 40°C
Storage Temperature Range	
w/Batteries	-10 — 50°C
Relative Humidity	70% max
Physical Characteristics	
Weight	
w/Batteries	3.75 lbs (1.62kg)
w/o Batteries	2.3 lbs (1.04kg)
Size	2.5 x 6.25 x 10.75 in (63,5 x 185,75 x 273,1mm)
Display	Non-blinking 1/3-inch high LED's. MSD flashes overrange for counts above 9999.
Stand	2-inch tilt-up for viewing ease
Conversion Time	200 — 400ms
Power	4 D-size Ni Cad batteries and/or converter-charger
Battery — Charge Life	10 hrs min
Charge Time (4.6V to Full Charge)	
Unit Off	14 hrs max
Unit On (trickle charge mode)	80 hrs max
Converter-Charger Operating Power	
Voltages (see options)	115Vac, 100Vac, 230Vac
Consumption w/charger	4W
Battery Drain	400mA max
Battery Check Accuracy (Function on Batt; Range on 10)	±1%

Table 1-3. Specifications (Continued)

DC VOLTS

Range	Resolution	R_{IN}
±100mV	10μV	1000MΩ
±1V	100μV	1000MΩ
±10V	1mV	10MΩ
±100V	10mV	10MΩ
±1000V	100mV	10MΩ

Accuracy (90 day; 25 ±10°C)
- ±100mV Range ..... ±(0.05% rdg +0.04% FS)
- ±1V Range ..... ±(0.04% rdg +0.02% FS)
- ±10V, ±100V, ±1000V Range ..... ±(0.06% rdg +0.02% FS)

Accuracy (1 yr; 25 ±10°C)
- ±100mV Range ..... ±(0.06% rdg +0.04% FS)
- ±1V Range ..... ±(0.05% rdg +0.02% FS)
- ±10V, ±100V, ±1000V Range ..... ±(0.07% rdg +0.02% FS)

Input Current ..... ≅100pA max (doubles every 10°C)

Maximum Input Voltage
- 1000V Range 1400Vdc/rms
- Other Ranges 1000Vdc/rms

Normal Mode Rejection ..... 40dB min (50Hz)

Common Mode Rejection ..... 100dB min (0 — 60Hz)

Common Mode Voltage ..... 1500V pk max (line operation)

Response Time (1V Step) ..... 800ms max

AC VOLTS (45Hz — 10kHz)

Range	Resolution	Z_{IN}
0 — 100mV rms	10μV	20MΩ 60pF
0 — 1V rms	100μV	20MΩ 60pF
0 — 10V rms	1mV	1MΩ 60pF
0 — 100V rms	10mV	1MΩ 60pF
0 — 1000V rms	100mV	1MΩ 60pF

Accuracy (90 day; ±10°C)
- 0 — 100mV Range ..... ±(0.15% rdg +0.08% FS)
- 0 — 1V Range ..... ±(0.15% rdg +0.03% FS)
- 0 — 10V, 0 — 100V, and 0 — 1000V Ranges ..... ±(0.5% rdg +0.03% FS)

Accuracy (1 yr; 25 ±10°C)
- 0 — 100mV Range ..... ±(0.15% rdg +0.08% FS)
- 0 — 1V Range ..... ±(0.15% rdg +0.03% FS)
- 0 — 10V, 0 — 100V, and 0 — 1000V Ranges ..... ±(0.5% rdg +0.03% FS)

Maximum Input Voltage
- Continuous
  - 100mV and 1V Ranges 330Vrms/1000Vdc
  - 10V, 100V, and 1000V Ranges 1000Vrms/dc
- Short Term (1 minute)
  - 100mV and 1V Ranges 450Vrms
  - 10V, 100V, and 1000V Ranges 1000Vrms/dc

Response Time (5V Step) ..... 4s max

Table 1-3. Specifications (Continued)

KILOHM

Range	Resolution	Test Current
0 — 100Ω	10mΩ	1mA
0 — 1kΩ	100mΩ	1mA
0 — 10kΩ	1Ω	100μA
0 — 100kΩ	10Ω	10μA
0 — 1MΩ	100Ω	1μA
0 — 10MΩ	1kΩ	100nA

Accuracy (90 day; 25 ±10°C)
- 0 — 100Ω Range ..... ±(0.08% rdg +0.08% FS)
- 0 — 1kΩ, 0 — 10kΩ, and 0 — 100kΩ Ranges ..... ±(0.07% rdg +0.02% FS)
- 0 — 100kΩ Ranges ..... ±(0.08% rdg +0.02% FS)
- 0 — 1MΩ Range ..... ±(0.09% rdg +0.02% FS)

Accuracy (1 yr; 25 ±10°C)
- 0 — 100Ω Range..... ±(0.09% rdg +0.1% FS)
- 0 — 1kΩ, 0 — 10kΩ, and 0 — 100kΩ Ranges ..... ±(0.08% rdg +0.02% FS)
- 0 — 1MΩ and 0 — 10MΩ Ranges ..... ±(0.1% rdg +0.02% FS)

Maximum Input Voltage
- Continuous 150Vrms
- Short Term (1 minute)..... 250Vrms

Response Time (1V Step)
- 10MΩ Range ..... 4s max
- Other Ranges ..... 800ms max

DC CURRENT

Range	Resolution	R_{IN}
±100μA	10nA	1kΩ
±1mA	100nA	100Ω
±10mA	1μA	10Ω
±100mA	10μA	1Ω
±1A	100μA	0.1Ω

Accuracy (90 day; 25 ±10°C)
- ±1A Range..... ±(0.12% rdg +0.06% FS)
- Other Ranges ..... ±(0.1% rdg +0.05% FS)

Accuracy (1 yr; 25 ±10°C)
- ±1A Range ..... ±(0.13% rdg +0.06% FS)
- Other Ranges ..... ±(0.11% rdg +0.05% FS)

Maximum Input..... 1A (fuse protected)

Response Time
- 1A Range..... 2s max
- Other Ranges ..... 800ms max

Table 1-3. Specifications (Continued)

AC CURRENT (45Hz — 10kHz)

Range	Resolution	R_{IN}
0 — 100μA rms	10nA	1kΩ
0 — 1mA rms	100nA	100Ω
0 — 10mA rms	1μA	10Ω
0 — 100mA rms	10μA	1Ω
0 — 1A rms	100μA	0.1Ω

Accuracy (90 day; 25 ±10°C) ..... ±(0.2% rdg +0.08% FS)
Accuracy (1 yr; 25 ±10°C) ..... ±(0.2% rdg +0.08% FS)
Maximum Input ..... 1A (fuse protected)
Response Time ..... 4s max

SECTION II
OPERATION

2-1. BATTERY INSTALLATION

2-2. To gain access to the batteries, remove the rear battery cover by first removing the four Phillips screws. As viewed from the rear, with the Model 45 in the upright position, direct the terminals of the batteries into the left-to-right battery positions as follows: minus, plus, minus, plus. These polarities are marked on the inside battery positions of the rear panel.

2-3. The batteries are protected from inadvertent damage as follows:

If the unit is operating from the converter-charger, only a trickle charge is supplied.

During battery-only operation, a circuit is employed to monitor the battery voltage. Should this voltage ever drop below 4.3 volts, the unit will automatically turn off. Operation can be returned with converter-charger operation or a battery charge.

2-5. BATTERY CHARGING AND OPERATION

2-6. To charge the batteries, connect the charger plug to the receptacle in the rear plate as well as to the 50 — 60 hertz power main. To determine when the batteries require charging, set the function switch to "BATT." The batteries should not be allowed to discharge below a 4.6 volt "BATT" reading as the performance is, thereby, reduced. With the unit OFF, the time required to reach full charge from the 4.6 volt point is 14 hours. With the unit ON, a full charge requires 80 hours. The full-charge "BATT" reading is about 5.6 volts. The life of the batteries is not shortened by extended charging, and the Model 45 may be operated while battery charging is in process. A full charge yields a minimum of 10 hours operation. The battery life should be in excess of 1000 charge-discharge cycles. Do not attempt to charge other than nickel cadmium batteries.

2-6. OPERATION

2-7. Operating the Model 45 consists of providing input connections and setting range and function switches consistant with the measured source.

CAUTION

If the display flashes, an overrange condition exists. Do not apply input levels in excess of those specified in Table 1-3 (Specifications).

2-8. Function Switch

2-9. The function switch sets the Model 45 for either dc volt, ac volt, dc milliampere, ac milliampere, or kilohm measurements, also batterv check and power OFF.

2-10. Range Switch

2-11. The range switch shifts the decimal point. The range switch also includes a 10 megohm position. Each funciton has five ranges — 0.1, 1, 10, 100, 1000, with the 10 megohm position providing an additional range position.

2-12. Zero

2-13. The zero potentiometer is accessible through a hole in the front panel. To set zero, short the input terminals and set the unit on the 0.1 range and DCV function. Using a small screwdriver, adjust for a 00.00 display with the polarity toggling.

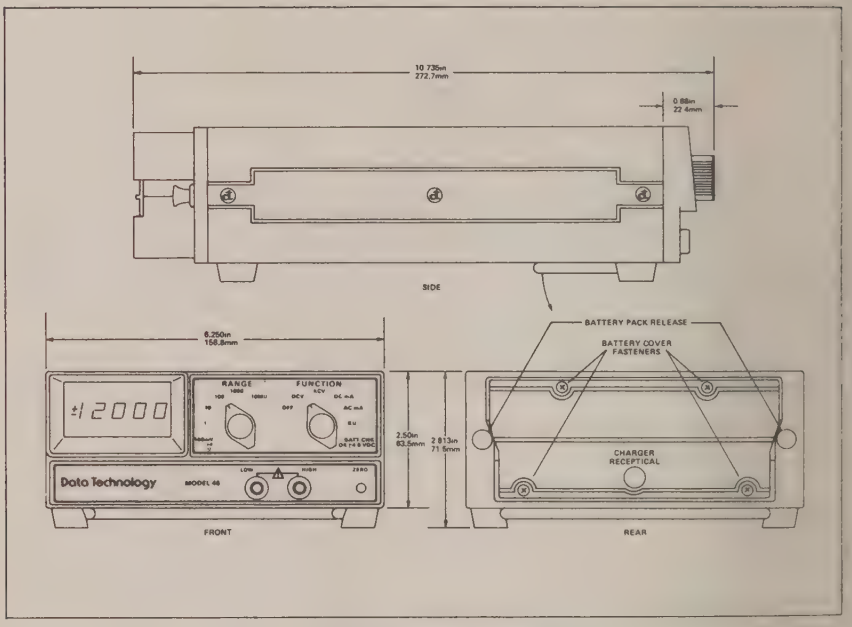


Figure 2-1. Physical Layout

SECTION III
THEORY OF OPERATION

3-1. GENERAL DESCRIPTION

3-2. Dual Slope Integration (Figure 3-1)

3-3. The Model 45 employs the dual-slope technique of converting analog levels to digital numbers. The integrator slope, during t1 time, is proportional to the input level. During t2 time, the slope is reversed and held constant, returning the integrator to the level of origin. When the level of origin is reached, the t2 count is displayed. This displayed number corresponds to the analog input.

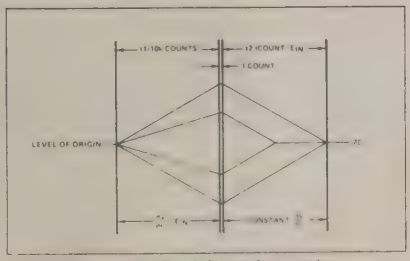


Figure 3-1. Dual Slope Integration

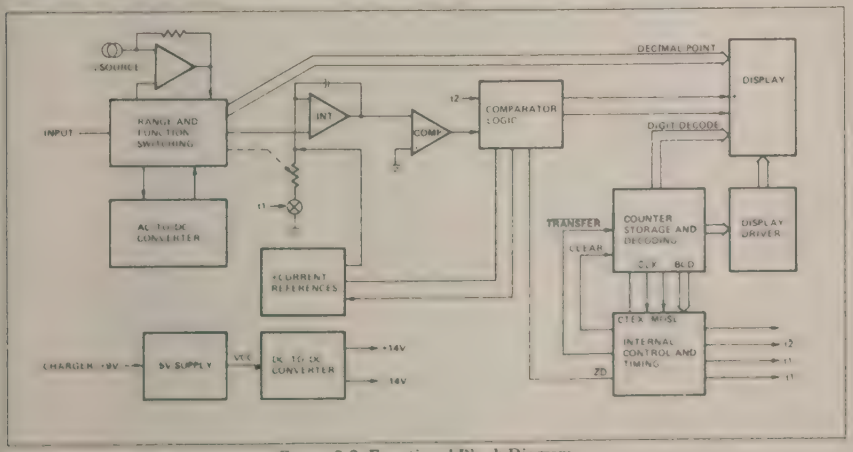


Figure 3-2. Functional Block Diagram

3-4. Functional Block (Figure 3-2)

3-5. The Model 45 includes an integrator, comparator, plus and minus current references and various digital control, timing, and display circuitry to form the basic converter. Additional circuits are the power supply, ac-to-dc converter, ohms current source and input switching, which add the function, range, and battery or line versatility.

3-6. The ANALOG INPUT is conditioned by range-and-function switch-selected circuits to provide a dc level to the integrator. During t1 time, the selected gain resistor of the integrator is connected to GROUND, and the current references are inhibited OFF. This condition makes the ANALOG INPUT the source for integration, and as a result, the integrator either ascends or descends — depending on input polarity — at a rate proportional to the input level.

3-7. During t2 time, one of the current references is enabled, the integrator gain resistor is disconnected from GROUND and is replaced by the enabled current reference as the source for the integrator. The selected current reference reverses the integration slope, returning the level to the point of origin.

3-8. When the point of origin is reached, the comparator changes state and a $\overline{ZD}$ pulse is transmitted. $\overline{ZD}$ triggers TRANSFER and CLEAR pulses. TRANSFER enters the accumulated t2 counts into storage. CLEAR resets the counter, reinstating t1 time.

3-9. The stored t2 count is multiplexed and decoded onto 4 by 4 and 4 by 7 formats of BCD and 7-segment coding. The 7-segment format is in turn demultiplexed for the 4-digit display.

3-10. INPUT AMPLIFIER INTEGRATOR AND COMPARATOR (FIGURE 3-3)

3-11. Referring to the simplified circuit, during t1 time, the current references are OFF and R36 is switched to GROUND. The ANALOG INPUT level is induced at the inverting input of the integrator amplifier due to feedback through C25. Thus, the current through R36 is a function of the ANALOG INPUT level and the t1 slope is a function of C25 and the current through R36. Note that in the actual circuit, R37 and R38 are placed in parallel with R36 in certain combinations of gain and function switch settings. When the value of R36 is thus reduced, the t1 slope is increased adjusting the circuit for sensitivity to lower input levels.

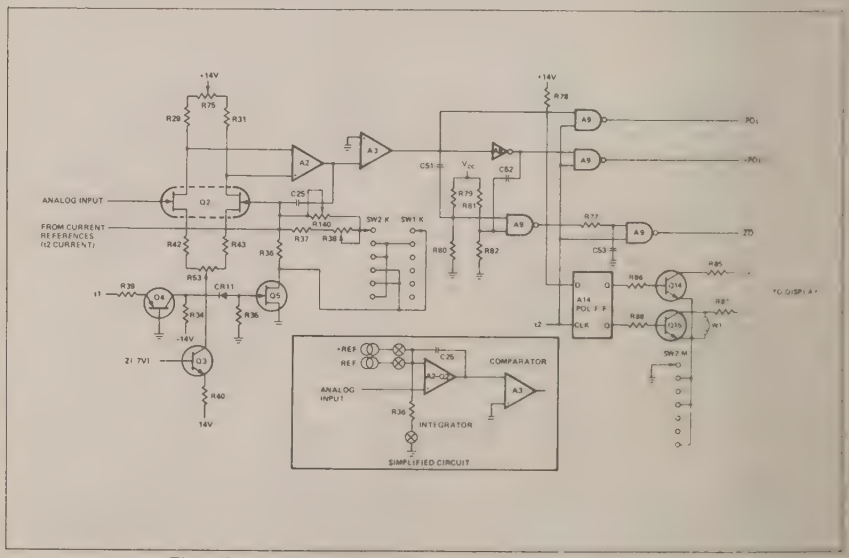


Figure 3-3. Input Amplifier, Integrator, and Comparator Circuitry

3-12. During t2 time, R36 is switched off of GROUND, and, depending upon the t1 slope, either the positive or negative current source is switched ON. This current is the reverse of t1 current, causing the integrator output to return to 0 volts. Zero volts are sensed by the comparator. When the comparator changes state during t2 time, a $\overline{ZD}$ pulse results. When t2 becomes a "1," the POLARITY flip-flop is clocked and the state of the comparator is entered into storage, updating the display. SW2-M inhibits POLARITY in all but the dc volt dc current functions.

3-13. COUNTER, STORAGE, AND DECODING CIRCUITRY (Figure 3-4)

3-14. The majority of this circuitry is incorporated in an LSI chip, the Mostek MK5002P. The MK5002P circuits include a counter, storage latches, decode circuitry and clocks. The CLEAR input resets the counter. The counter is then clocked through 9999 counts at which time a COUNT EXTEND pulse is issued. Continued clocking recycles the counter with the clocking now in the t2 time segment. The TRANSFER pulse transfers the accumulated t2 counts into storage latches. The latch outputs are multiplexed onto four data lines and four decode lines. The four data lines are in a BCD format and are available as outputs. The BCD data is decoded to the seven-segment format required by the displays. The data outputs, both BCD and seven-segment, are validated by the digit-select lines such that a "1" on the MDSL line validates the most significant digit; a "1" on the 2DSL line validates the second significant digit and so forth. The cycle rate of the digit-select lines is controlled by the scan rate which is controlled by C57.

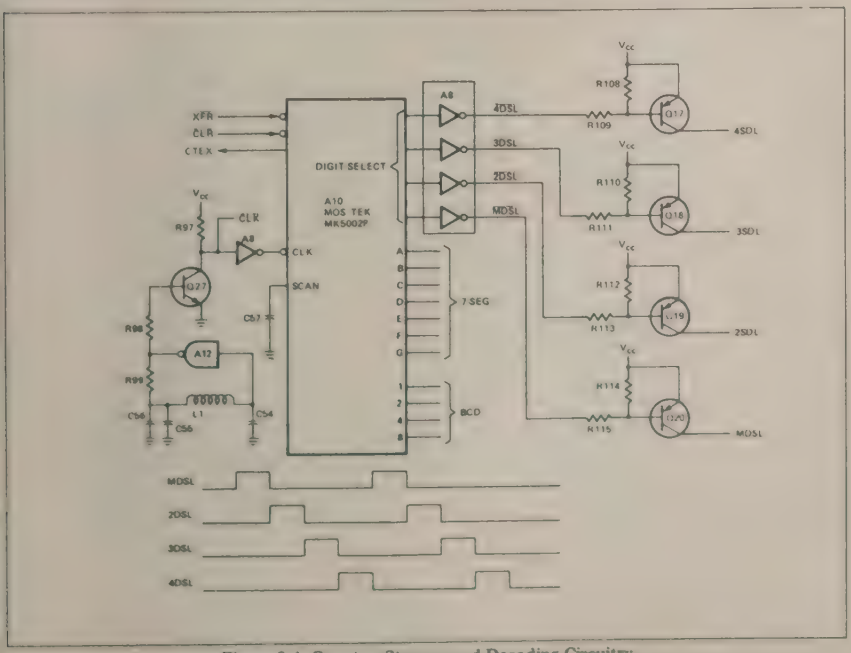


Figure 3-4. Counter, Storage, and Decoding Circuitry

3-15. INTERNAL CONTROL AND TIMING

3-16. The internal control and timing establishes t1 and t2 times as well as the overrange flash. The $\overline{ZD}$ signal clears the CLEAR flip-flop which is subsequently set when C40 charges, allowing the "D" input to return to a logical "1" which is then clocked to the "Q" output. The positive edge of the CLEAR pulse is synchronized with the clock and the width is controlled by R83, R84, and C40. The CLEAR flip-flop produces two signals — TRANSFER, which enters the t2 count into storage, and CLEAR, which resets the counter.

3-17. The CLEAR signal also resets the t1 and sets the t2 flip-flops, terminating t2 time and initiating t1 time. After 9999 counts, COUNT EXTEND ($\overline{CTEX}$), resets the t1 flip-flop, terminating t1 time. One clock period later the new level at the "D" input of the t2 flip-flop is clocked to the "Q" output (t1=0) and t2 time is initiated. The process repeats with the following $\overline{ZD}$ signal.

3-18. If a COUNT EXTEND occurs during t2 time, approximately 9999 counts of t2 time have elapsed. Subsequent counting is in the overrange region. This event is signaled when the OVERRANGE flip-flop is clocked by the NANDing of t2 and COUNT EXTEND ($t2 \cdot \overline{CTEX}$). At the end of t1 time, the OVERRANGE flip-flop is reset with the result, a flash of the same duration as t1 time. Note that BC01, BC08, and MDSL are NANDed. This $\overline{BC01 \cdot BC08 \cdot MDSL}$ signal also causes the OVERRANGE flip-flop to reset, preventing OVERRANGE from being indicated prior to the 10000th count of t2 time.

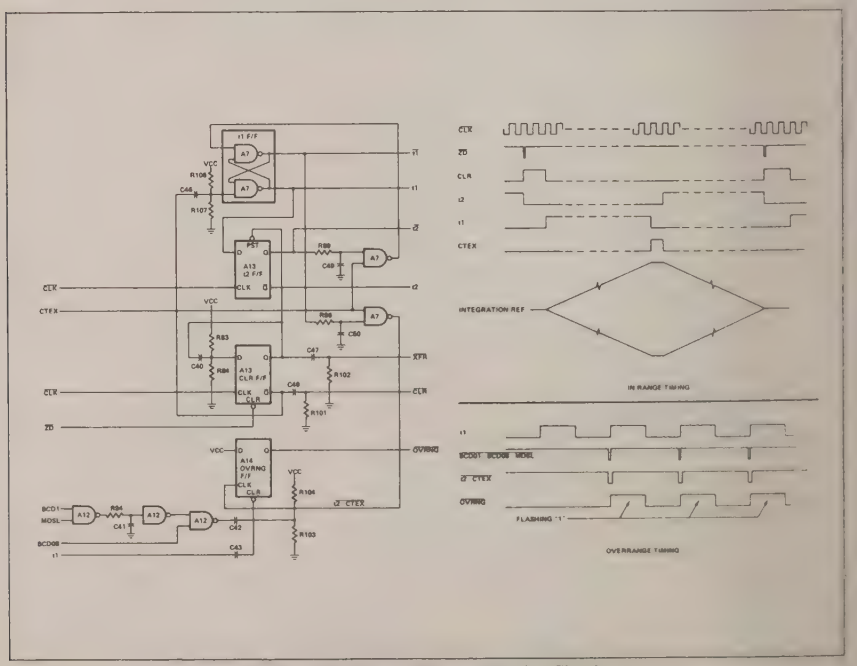


Figure 3-5. Internal Control Timing Circuitry

3-19. DISPLAY CIRCUITRY (Figure 3-6)

3-20. The display digits are serially enabled as the MDSL through LDSL lines each go to +5 volts, thereby, demultiplexing the 7-segment data. SW1-C determines the enabled decimal point. The OVER-RANGE line is toggled for overrange conditions, flashing the "1."

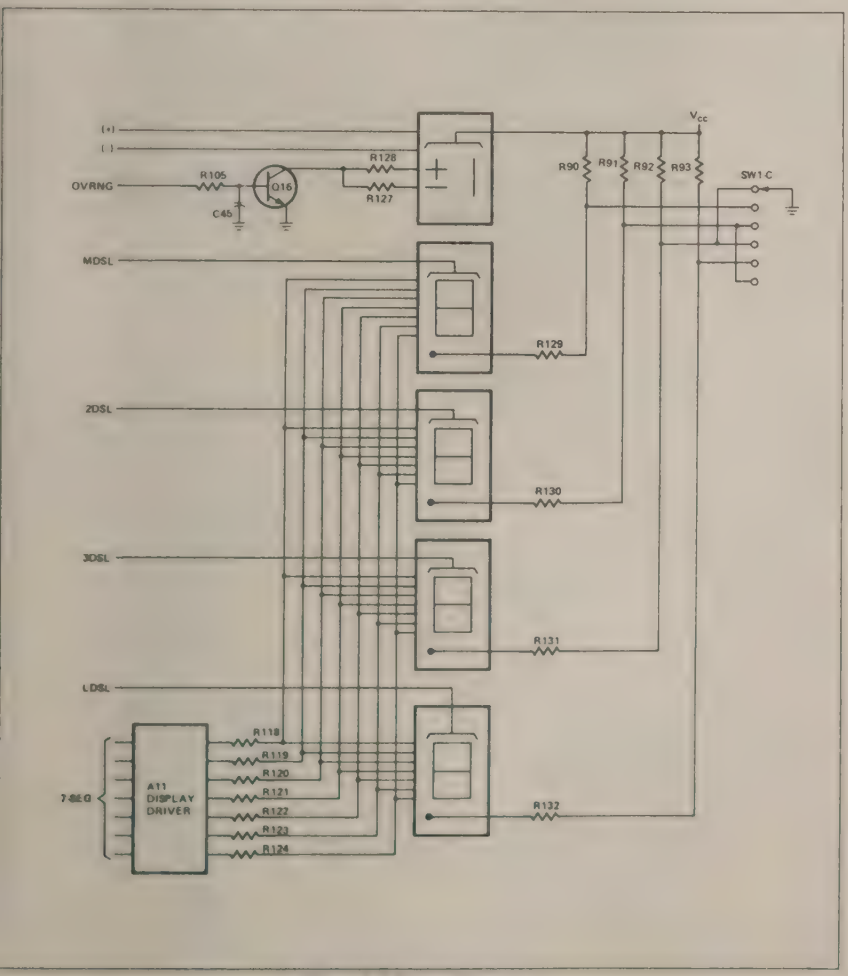


Figure 3-6. Display Circuitry

3-21. CURRENT REFERENCES (Figure 3-7)

3-22. The voltages established by zener diodes CR12 and CR13 provide reference levels for the noninverting inputs of A5 and A6. These voltages also appear at the inverting inputs of A5 and A6 due to the feedback loops. Output current from the positive current source is a function of the voltage supplied by CR12 and the resistance of R46, R47, and R138. Similarly, negative current is a function of CR13, R51, R52, and R139.

3-23. Diode switches establish which reference supplies current to the input amplifier during t2 time. When the input is positive, $\overline{+POL}$ is a "0," $\overline{-POL}$ is a "1," Q7 and Q10 are ON, CR14 and CR17 are forward biased, and CR15 and CR16 are reverse biased. When the input is negative, the aforementioned conditions all reverse.

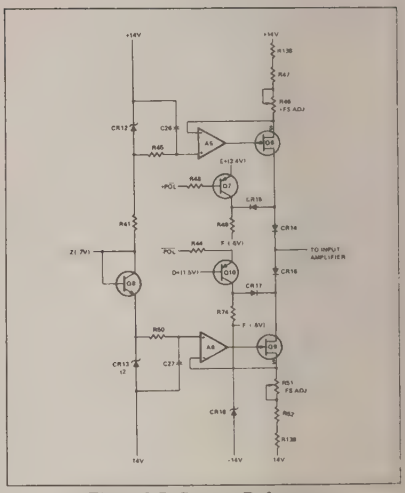


Figure 3-7. Current References

3-24. ac-to-dc CONVERTER (Figure 3-8)

3-25. The ac-to-dc converter is a precision rectifier. The rectifier diodes, CR33 and CR34, are

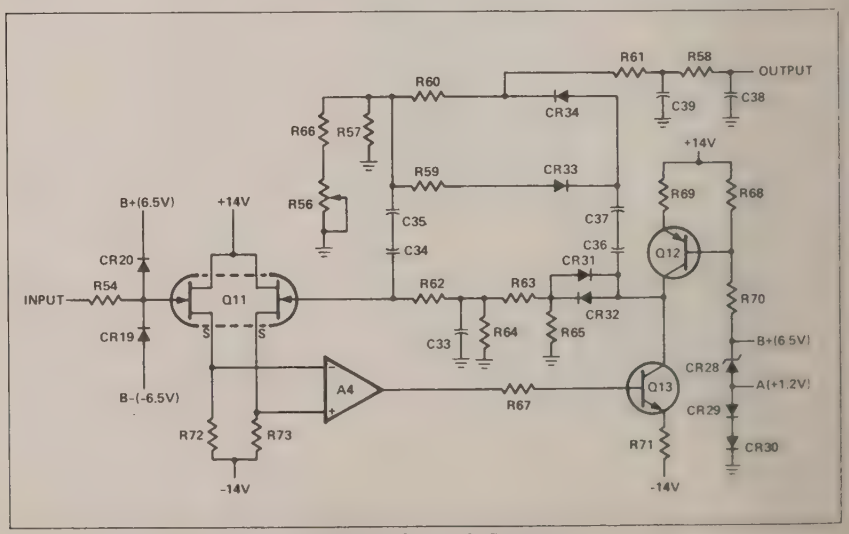


Figure 3-8. ac-to-dc Converter

in the feedback to reduce nonlinearity. The gain is a function of the ratio of ac feedback resistors to the shunt resistance (R56 and R57).

3-26. INPUT SWITCHING – VOLTAGE FUNCTIONS (Figure 3-9)

3-27. Figure 3-9 shows only the wiring for the voltage functions. This circuitry determines the input configuration and attenuation. SW2-A determines whether the unit is ac or dc coupled. SW2-B shunts 20 megohms to GROUND in the ac position. SW2-N grounds the input to the ac-to-dc converter in the dc position. SW1-B connects the input directly to the ac-to-dc converter in positions one and two for the ac voltage function, and shunts R23 across R1 and R12 in positions one and two for the dc voltage function. In positions three, four and five of SW1-B and the ac voltage function, the attenuator output is connected to the ac-to-dc converter, SW2-C connects the converter input to the attenuator output for the dc voltage function and connects the converter input to the ac-to-dc converter output for the ac voltage function. SW1-J selects capacitors to maintain the normal mode rejection for the various attenuator positions. SW2-D, E, F, and H with SW1-D, E, and F determine the attenuation.

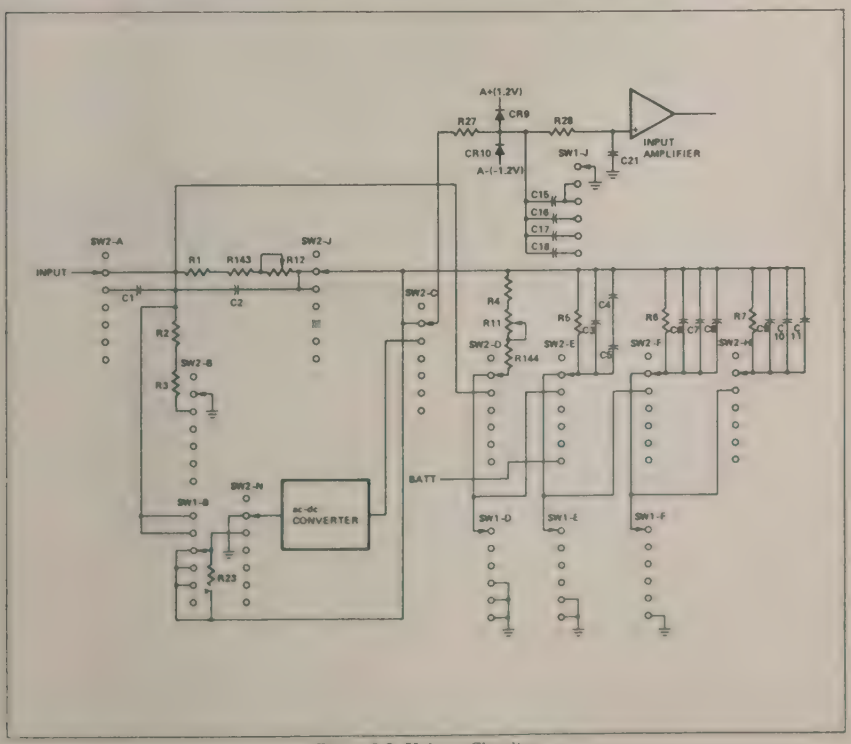


Figure 3-9. Voltage Circuitry

3-28. INPUT SWITCHING – CURRENT FUNCTIONS (Figure 3-10)

3-30. Figure 3-10 shows only the wiring for the current functions. This circuitry determines the input configuration and the input resistance. SW2-A connects the input high to the input resistance value. SW2-C and SW2-N place the ac-to-dc converter in series with the input high and the converter input for the ac current function. The circuitry including CR1 through CR4 and R13 and R14 provides protection for the input resistors by preventing voltages in excess of about 2 volts from developing across the input resistance. Under normal conditions, CR1 and CR2 are reverse biased by R13 and R14.

3-30. INPUT SWITCHING – OHM FUNCTION (Figure 3-11)

3-31. Figure 3-11 shows only the wiring for the ohm function. This circuitry determines the cur-

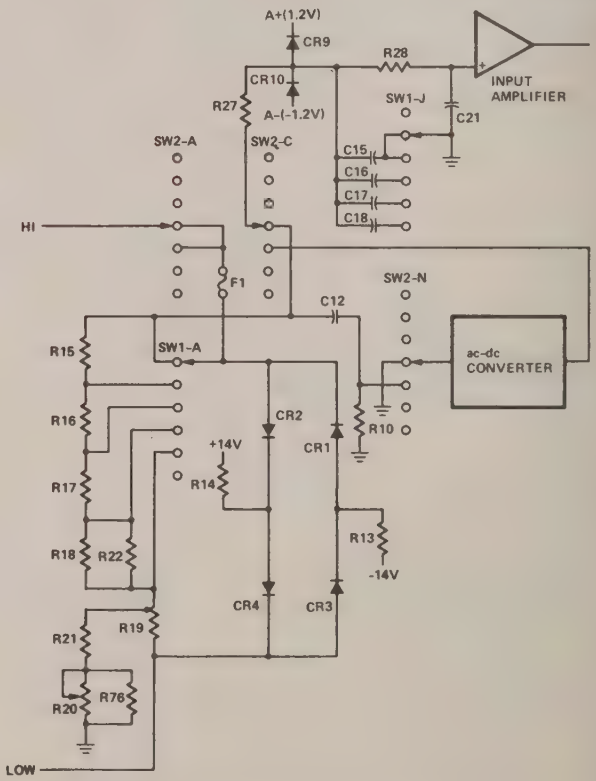


Figure 3-10. Current Circuitry

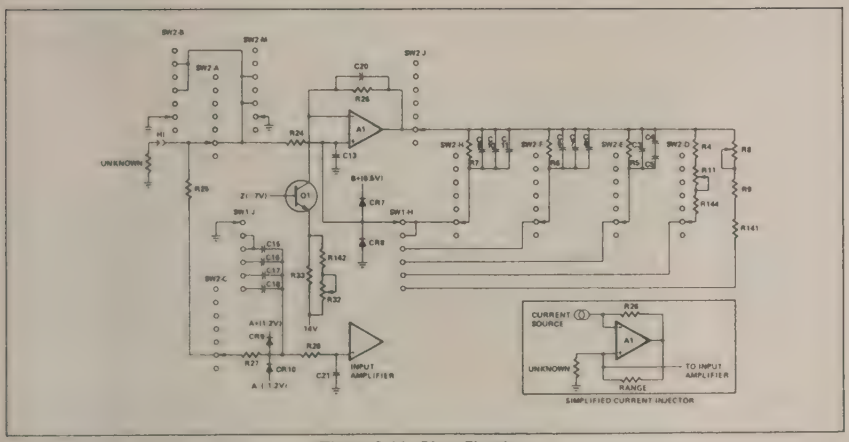


Figure 3-11. Ohm Circuitry

rent flowing in the unknown. The basic circuit is a current injector. Referring to the simplified circuit, the current from the current source flows through R26. The voltage across R26 also appears across the range control resistor. The value of the range control determines the current through the range control and, therefore, the current through the unknown.

3-32. 5-VOLT SUPPLY (Figure 3-12)

3-33. The 5-volt supply has four modes of operation — battery only, charger only, unit off

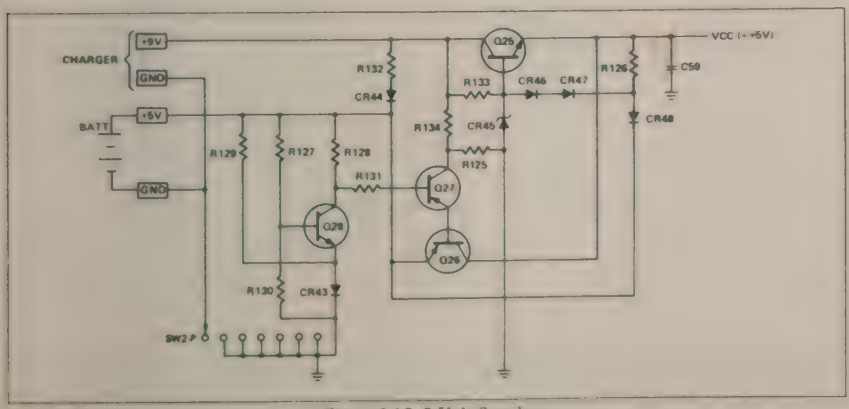


Figure 3-12. 5-Volt Supply

and batteries charging, and charger operation and batteries charging.

3-34. When the charger is connected and SW2-P is ON, the 5-volt output is the result of the zener controlled pass transistor (CR45 and Q25). Q26 is OFF because the 9-volt source back biases the base-emitter junction of Q26. If batteries are installed, a trickle charge current is simultaneously supplied via R132 and CR44. CR48 is back biased, having 5-volt sources on both terminals. If SW2-P is OFF, all circuit grounds are disconnected. The only current paths from the charger are to the battery; CR45 no longer controls pass transistor Q25; Q25 therefore turns ON; CR48 becomes forward biased; and, additional charge current flows through R126 and CR48.

3-35. When the charger is not connected, the 5-volt output is the result of Q26 being switched ON by base current supplied by R125 through Q27. Q26 and, thus, Q27 are ON as long as the battery voltage is above 4.4 volts. When the battery voltage falls below this level, Q28 turns OFF as does Q27 and Q26. No further operation is possible without the charger or a battery charge.

3-36. dc-to-dc CONVERTER (Figure 3-13)

3-37. At turn on, Q22 turns ON, Q21 is biased OFF as T1 is driven to saturation. Saturation causes the field of T1 to collapse. As the field collapses into the reverse direction, Q22 turns OFF and Q21 turns ON. Q21 now drives T1 to saturation in the reverse direction. The ac voltage supplied to T1 is, thus, the result of Q21 and Q22 alternately driving T1 from saturation level to saturation level.

3-38. The ±14-volt regulators are full-wave rectifiers with capacitance input filters and zener controlled pass transistors.

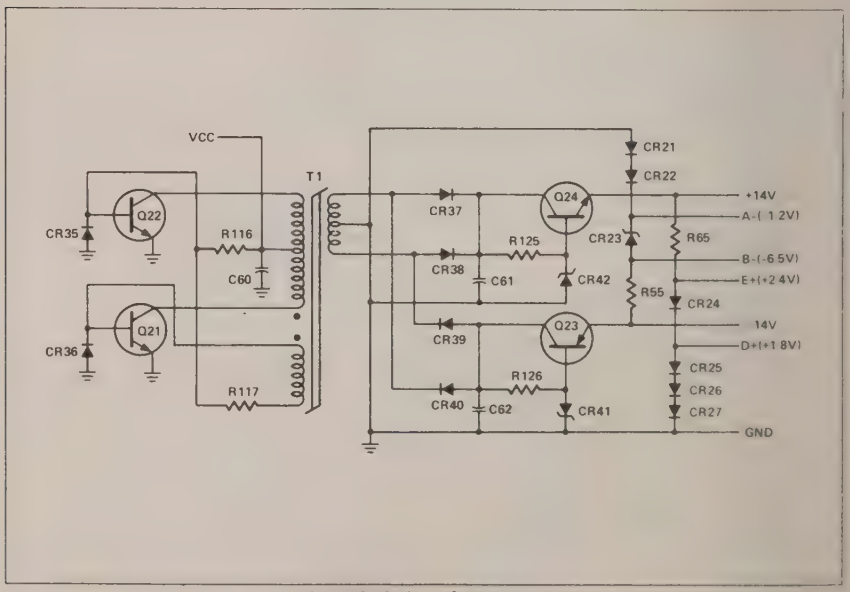


Figure 3-13. dc-to-dc Converter

SECTION IV
CALIBRATION AND AID TO TROUBLESHOOTING

4-1. TEST EQUIPMENT

4-2. Test equipment suitable for calibration or repair is specified in Table 4-1.

Table 4-1. Test Equipment

Test Equipment	Accuracy
Voltmeter	0.01%
dc Voltage Standard	0.01%
ac Voltage Standard	0.02%
Resistance Standard	0.05%
dc Current Standard	0.02%
ac Current Standard	0.1%

4-3. CALIBRATION

4-4. The accuracy of the Model 45 should be verified at either 90-day or 1-year intervals (see specifications). The accuracy is confirmed when known inputs yield corresponding displays, within specified accuracy.

4-5. CALIBRATION PROCEDURE (Figure 4-1)

1. Pull the two nylatch fasteners on the rear module, and remove the top cover and shield.

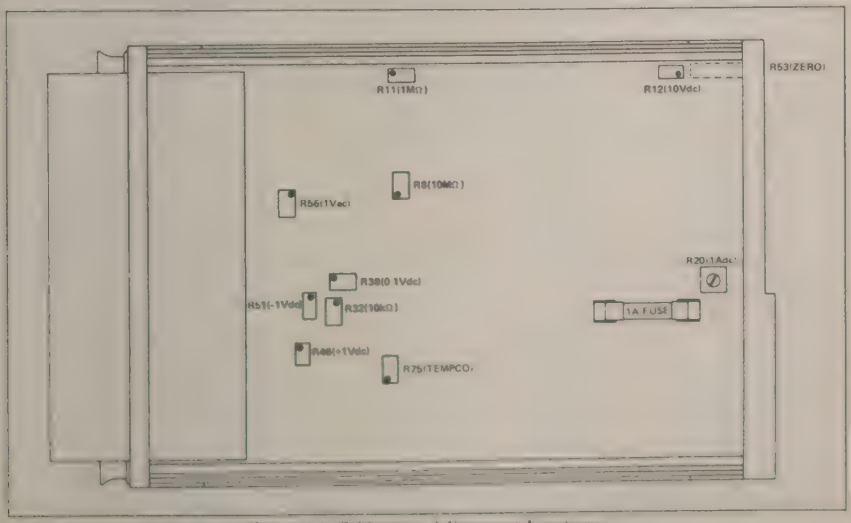


Figure 4-1. Calibration Adjustment Locations

2. Replace and secure the rear module by repositioning the module and pressing the nylatch fasteners.

3. If the unit is being calibrated without the charger, verify a display of 4.600 or greater with the function switch set to "BATT."

4. Allow a 5-minute warm-up and proceed with Table 4-2.

4-6. FACTORY REPAIR

4-7. Data Technology maintains a factory repair facility. Our trained technicians are available to repair your instruments with a minimum of inconvenience to you. Refer to the customer service card inside the back cover for equipment return instructions.

4-8. AID TO TROUBLESHOOTING

4-9. The checks which follow should serve to isolate the problem to a specific functional area. When specified results are not obtained, reference is given to the applicable drawing in Section VI and the applicable paragraph in Section III. Refer to the applicable layout drawing in Section VI for component locations.

NOTE

Before attempting any repairs, read the warranty on page iii.

4-10. The following checks are arranged in an order of dependency and, therefore, the order of testing should be as presented.

4-11. A complete access to the internal assemblies requires only that the two nylatch fasteners on the rear module be pulled. The rear module is then withdrawn and the top and bottom covers and shields removed. Return the rear module and push the nylatch fasteners to make the unit operational with top and bottom covers removed.

4-12. Power Supply Checks

4-13. Perform the checks specified in Table 4-3.

Table 4-2. Calibration Adjustments

Input	Function	Range	Adjust	Display
Short	DCV	0.1	R53 (ZERO)	±00.00
+1.0000Vdc	DCV	1	R46 (+1Vdc)	+1.0000
-1.0000Vdc	DCV	1	R51 (-1Vdc)	-1.0000
+100.00mVdc	DCV	1	R38 (0.1Vdc)	+100.00
10.000kΩ	KΩ	10	R32 (10kΩ)	10.000
1.0000MΩ	KΩ	1000	R11 (1MΩ)	1000.0
10.000MΩ	KΩ	10MΩ	R8 (10MΩ)	10.000
+10.000Vdc	DCV	10	R12 (+10Vdc)	+10.000
1.0000V 1kHz	ACV	1	R56 (1Vac)	1.0000
1.0000Adc	DCmA	1000	R20 (1Adc)	+1000.0

Vdc Standard 0.01% Total Accuracy
Vac Standard 0.02% Total Accuracy
ΩStandard 0.05% Total Accuracy
Adc Standard 0.02% Total Accuracy
Aac Standard 0.1% Total Accuracy

Table 4-3. Power Supply Checks

Test Points HI	LO	Conditions	Test Point Voltage (dc)	For Failure See
Q25 col	Input Lo	Charger & Batt's in	+9V	Dwg 548910, pg 2; par 3-32; charger
C59 "+"	Input Lo	Charger & Batt's in	+5V	Dwg 548910, pg 2; par 3-32
C59 "+"	Input Lo	Charger out Batt's in	Batt V (≈5V)	Dwg 548910, pg 2; par 3-32
	Note: Combined battery voltage must exceed 4.5 volts for results in preceding tests. To check automatic shut-off feature, replace the batteries with an external source variable from 0 to 5.5 volts and capable of 500 milliamperes. Do not use the charger. Note that the unit is off below about 4.3 volts and on above 4.4 volts. Do not exceed 5.5 volts.			Dwg 548910, pg 2; par 3-32
Q24 emit	Input Lo	Charger or Batt operation	+13.5V	Dwg 548910, pg 2; par 3-36
Q23 emit	Input Lo	Charger or Batt operation	-13.5V	Dwg 548910, pg 2; par 3-36
CR24 cath	Input Lo	Charger or Batt operation	1.8V	Dwg 548910, pg 1; par 3-36
CR24 anode	Input Lo	Charger or Batt operation	+2.4V	Dwg 548910, pg 1; par 3-36
CR23 cath	Input Lo	Charger or Batt operation	-1.2V	Dwg 548910, pg 1; par 3-36
CR23 anode	Input Lo	Charger or Batt operation	-6.5V	Dwg 548910, pg 1; par 3-36
CR28 anode	Input Lo	Charger or Batt operation	+1.2V	Dwg 548910, pg 1; par 3-24
CR28 cath	Input Lo	Charger or Batt operation	+6.5V	Dwg 548910, pg 1; par 3-24
CR18 cath	Input Lo	Charger or Batt operation	-5V	Dwg 548910, pg 1; par 3-21
Q8 col	Input Lo	Charger or	-7V	Dwg 548910, pg 1; par 3-21

NOTE When specified voltage is not present because of loading, components may have to be removed to isolate the circuit drawing excessive current. (See drawing 548910.)

Table 4-4. Converter Checks

Test Points HI	Test Points LO	Function	Range	Input	Results	For Failure See
A10 pin 4	Input Lo	—	—	—	40 to 60kHz clock	Dwg. 548910, pg 2; par 3-13
A10 pin 10	Input Lo	—	—	—	0.5 to 1.5kHz clock	Dwg. 548910, pg 2; par 3-13
Q17 col	Input Lo	—	—	—	0.6 to 2ms +5V pulses	Dwg. 548910, pg 2; par 3-14
Q18 col	Input Lo	—	—	—	0.6 to 2ms +5V pulses	Dwg 548910, pg 2; par 3-14
Q19 col	Input Lo	—	—	—	0.6 to 2ms +5V pulses	Dwg 548910, pg 2; par 3-14
Q20 col	Input Lo	—	—	—	0.6 to 2ms +5V pulses	Dwg 548910, pg 2; par 3-14
A10 pin 5	Input Lo	—	—	—	≈20μs +5V pulses	Dwg 548910, pg 2; par 3-15
A2 pin 6	Input Lo	DCV	1	+0.9999Vdc	dual slope wave; pos then neg slopes	①Dwg 548910, pg 1 par 3-10, 3-13, 3-15, 3-21, 3-26
A2 pin 6	Input Lo	DCV	1	-0.9999Vdc	dual slope wave; neg then pos slopes	①Dwg 548910, pg 1 par 3-10, 3-13, 3-15, 3-21, 3-26
—	—	DCV	1	-0.0001Vdc	"-" display	Dwg 548910, pg 2; par 3-10, 3-19
—	—	DCV	1	+0.0001Vdc	"+" display	Dwg 548910, pg 2; par 3-10, 3-19
—	—	ACV, ACmA KΩ	1	open	No polarity indication	Dwg 548910, pg 1; par 3-10
—	—	DCV	1	0 — 1.0000	Verify all display digits count 0 — 9, except MSD which only flashes "1"	Dwg 548910, pg 2; par 3-13, 3-19
—	—	DCV	All	—	decimal point corresponds to range position	Dwg 548910, pg 2; par 3-19
A13 pin 6	—	DCV	1	0V	50 — 80μs +5V pulses	Dwg 548910, pg 2; par 3-15

Table 4-4. Converter Checks (Continued)

Test Points HI	Test Points LO	Function	Range	Input	Results	For Failure See
—		—	10M		decimal point @ 99.99	Dwg 548910, pg 2; par 3-19
		DCV	1	0 — .9999V	no display flash	Dwg 548910, pg 2; par 3-15, 3-19
		DCV	1	② 1.0000V 2.0000V	display "1" flash	Dwg 548910, pg 2; par 3-15, 3-19

① The feedback loop of the converter prevents checks which lead directly to the malfunctioning functional area. The circuitry encompasses the following IC's: A2, A3, and A5 through A10, A13, and A14; also, transistors Q2 through Q10 and Q29.

② Display value not necessarily related to input, past ≈1.2000V.

4-14. Converter Checks

4-15. Perform the checks specified in Table 4-4.

4-16. Input Function Checks

4-17. Check each function using a corresponding input. Refer to Table 4-5 for failure references.

Table 4-5. Function Failure References

Function	For Failure See
DCV	Dwg 548910, pg 1; par 3-26
ACV	Dwg 548910, pg 1; par 3-24 & 3-26
DCmA	Dwg 548910, pg 1; par 3-28
ACmA	Dwg 548910, pg 1; par 3-24 & 3-28
KΩ	Dwg 548910, pg 1, par 3-30
① BATT	Dwg 548910, pg 1; par 3-26

① Batteries must be installed

SECTION V
SPECIAL MODIFICATIONS
(TO BE FILLED IN WHEN UNITS ARE MODIFIED)

DESCRIPTION OF MODIFICATION(S)

CHANGES IN SPECIFIED OPERATION(S)

DRAWINGS APPLICABLE TO MODIFICATION(S)

SECTION VI
DRAWINGS AND PARTS LISTS

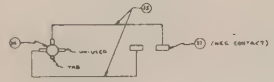
6-1. GENERAL

6-2. This section contains schematics, layout drawings, and parts lists.

6-3. DRAWINGS AND PARTS LISTS

Drawing Number	
548900	Model 45, 4-Digit Multimeter Assembly
548910	Model 45, 4-Digit Multimeter, Schematic Diagram
548932 page 1	Mother Board Assembly, 4-Digit Multimeter, Model 45
548932 (ref)	Mother Board Assembly, Parts List
548934	Display Board Assembly, 4-Digit, Model 45
548934 (ref)	Display Board Assembly, Parts List

WIRING DIAGRAM



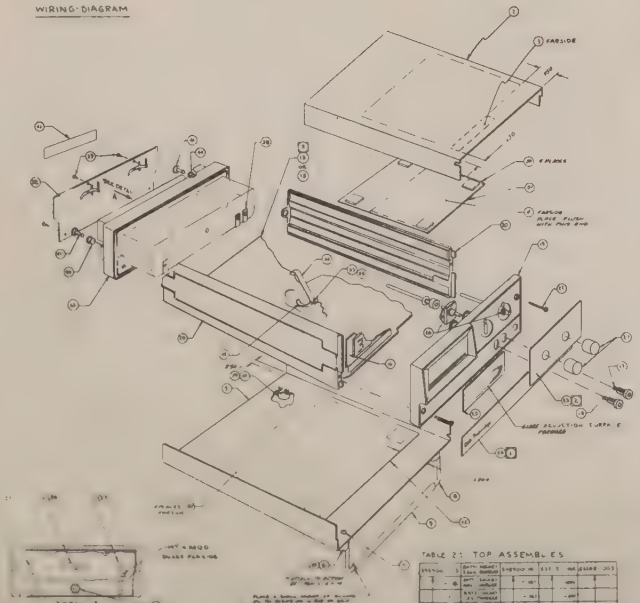
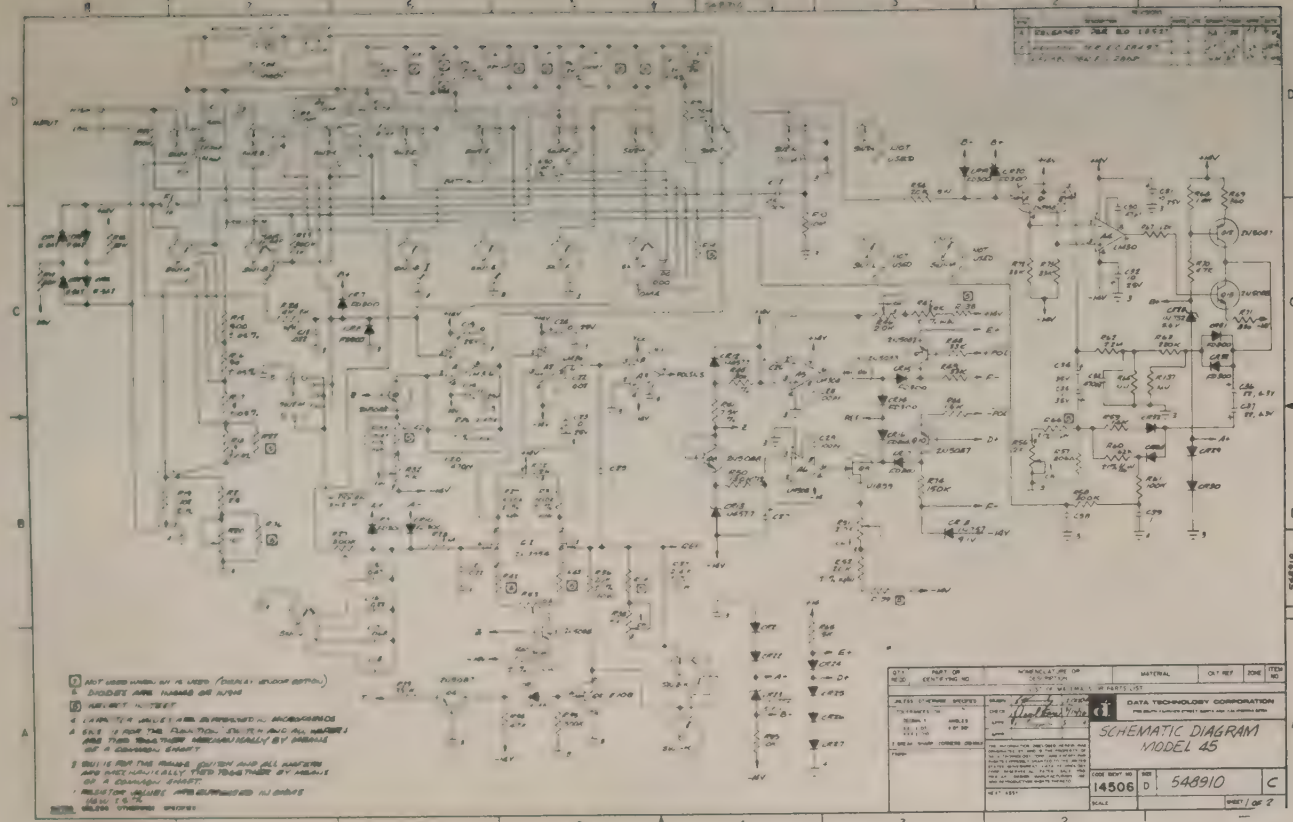
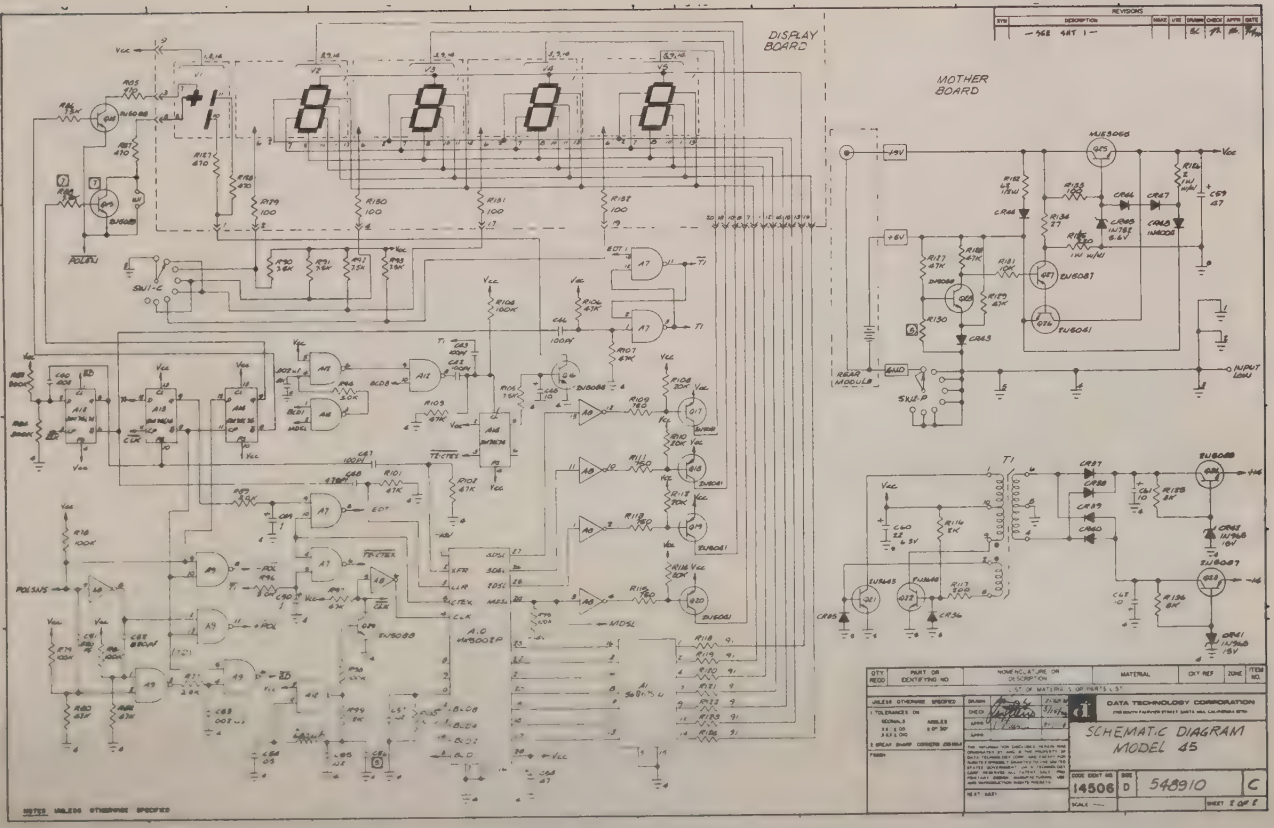
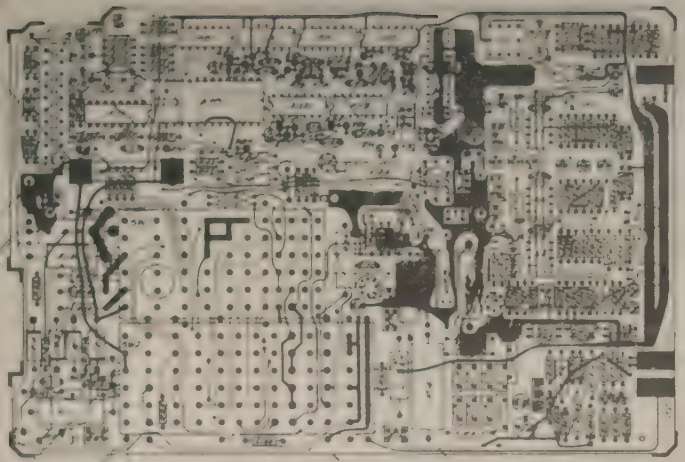


TABLE 1: LIST OF MATERIALS

TABLE 2: TOP ASSEMBLIES


DATA TECHNOLOGY CORPORATION
SCHEMATIC DIAGRAM
MODEL 45
CODE IDENT NO
14506
SIZE
D
548910
C
SCALE
SHEET 1 OF 2


DISPLAY BOARD
MOTHER BOARD
REAR MODULE
SKIP
INPUT 100u
SCHEMATIC DIAGRAM
MODEL 45
DATA TECHNOLOGY CORPORATION
548910
14506
SHEET 2 OF 2



DRAWING D548932-B01 IDENT. AL TO A548932-E00 EXCEPT ADD [illegible]

TO BE SELECTED IN TEST

3 CONNECT PAD 11 SOLDER SIDE OF BOARD TO EMIT N 1 HOUSE OF CONTACTS 2 & 3 C1 & IN ITEM 25

IDENTIFY PART PER DATA TECHNOLOGY EMP. [illegible]

REFERENCE SCHEMATIC S489...

NOTES UNLESS OTHERWISE SPECIFIED

QTY REQD	PART OR IDENTIFYING NO	NOMENCLATURE OR DESCRIPTION	MATERIAL	CKT REF	ZONE	ITEM NO
		... MATERIALS OR PARTS LIST				

UNLESS OTHERWISE SPECIFIED
TOLERANCE ± 2%
DECIMAL ANGLES
XX ± .05 ± 0° 30'
XXX ± .01
3 PLACE DECIMAL [illegible]

DRAWN [illegible]
CHECKED [illegible]
APPD [illegible]

DATA TECHNOLOGY CORPORATION
[illegible] MOUNTAIN VIEW, CALIFORNIA 94040

MOTHER BOARD ASSY
MODEL 45

CODE IDENT NO 14506
SIZE D
548932 D
SCALE 3/1
SHEET 1 OF 2

NEXT ASSY 548900

548932

REPLACEABLE PARTS LIST

Model Model 45

Description Mother Board Assembly

Data Tech No	Description	Source 1		Source 2		Source 3	
		Code Ident	Mfg & Type	Code Ident	Mfg & Type	Code Ident	Mfg & Type
532069-001	A1 Int. Ckt	27014	National Semiconductor LM316				
531968-001	A2, A4 Int. Ckt.	27014	National Semiconductor LM301				
532065-001	A3 Int. Ckt.	27014	National Semiconductor LM311				
821169-010	A5, A6 Int. Ckt.	27014	National Semiconductor LM308				
532057-001	A7, A9, A12 Int. Ckt.	27014	National Semiconductor DM74L00				
532057-002	A8 Int. Ckt.	27014	National Semiconductor DM74L04				
532054-001	A10 Int. Ckt.		Mostek Corporation MK5002P				
532072-001	A10 I.C. Socket, 28 Pin	01295	Texas Instruments C822854				
532114-001	A11 Int. Ckt., Low Power TTL		Silicon General SG8675N				
532057-004	A13, A14 Int. Ckt., Low Power TTL	27014	National Semiconductor DM74L74				
531338-078	C1 Cap. 0.1μF	56289	Sprague Electric Co. 5GA-P10				
531338-079	C2 Cap. 5pF	56289	Sprague Electric Co. 10TS-V50				
530333-999	C3, C4, C5, C7, C8, C11 Cap.	72136	Electro Motive Test Selected	00853	Sangamo Electric Test Selected		

Drawing No 548932

Data Tech No	Description	Source 1		Source 2		Source 3	
		Code Ident	Mfg & Type	Code Ident	Mfg & Type	Code Ident	Mfg & Type
503980-821	C6 Cap. 820pF	72136	Electro Motive DM15E821J050W10CR	00853	Sangamo Electric		
503980-822	C9 Cap. 8200pF	72136	Electro Motive DM19B822J100V1	00853	Sangamo Electric D191E822JP		
503980-999	C10 Cap	14752	Electro Motive Test Selected				
531338-001	C12, C54 Cap. 0.05μF	56289	Sprague 55C23A7				
531568-012	C13, C16, C21 Cap. 0.022μF	14752	Electro Cube 210B1B223M				
532043-043	C14, C19, C23, C24, C31, C32, C45, C61, C62 Cap. 10μF	14433	ITT Semiconductor TAG-14-10.0-25-20				
531568-014	C15 Cap. 0.047μF	14752	Electro Cube 210B1B473M				
531568-001	C17 Cap. 0.068μF	27556	IBM Electronics Products XA2B683	14752	Electro Cube 210B1B683M		
531568-005	C18 Cap. 0.1μF	27556	IBM Electronics Products XA2C104K	14752	Electro Cube 210B1B104K		
531338-050	C20, C33, C48 Cap. 470pF	56289	Sprague 5GA-T47				
531338-061	C22, C40 Cap. 0.002μF	56289	Sprague 5GA-D20				
531568-003	C25, C38, C39 Cap. 1μF	27556	IBM Electronics Products XA2B105	14752	Electro Cube 210B1B105M		
532043-037	C26, C27, C34, C35, C49, C50 Cap. 1μF	14433	ITT Semiconductor TAG-.11-1.0/25-20				
531338-038	C28, C29, C42, C43, C46, C47 Cap. 100pF	56289	Sprague Electric Co. 5GA-T10				

Data Tech No	Description	Source 1		Source 2		Source 3	
		Code Ident	Mfg & Type	Code Ident	Mfg & Type	Code Ident	Mfg & Type
531338-032	C30 Cap. 47pF	56289	Sprague Electric Co. 5GA-Q47				
532043-013	C36, C37, C60 Cap. 22μF	14433	ITT Semiconductor TAG-.12-15.0/6.3-20				
531338-080	C51, C52, C53 Cap. 820pF	56289	Sprague Electric Co. 10TS-T82				
531338-074	C55, C57 Cap. 0.02μF	56289	Sprague Electric Co. 5GAS-S20				
531338-999	C56 Cap.	56289	Sprague Electric Co. Test Selected				
532043-015	C58, C59 Cap.	14433	ITT Semiconductor TAG-.14-47.0/6. 3-20				
532070-001	CR1, CR2, CR3, CR4 Diode		Semicon Inc. S-3A2				
531964-001	CR7, CR8, CR9, CR10, CR14, CR15, CR16, CR17, CR19, CR20, CR31, CR32 Diode	07263	Fairchild Semiconductor FD300				
820284-010	CR11, CR21, CR22, CR24, CR25, CR26, CR27, CR29, CR30, CR33, CR34, CR35, CR36, CR37, CR38, CR39, CR40, CR43, CR44, CR46, CR47 Diode	01295	Texas Instruments 1N4148 or 1N914	14433	ITT Semiconductor 1N4148 or 1N914		
818944-250	CR12, CR13 Diode	04713	Motorola Semiconductor 1N4577				
503176-012	CR18 Diode	01295	Texas Instruments 1N757A	73293	Hughes 1N757A		
503176-007	CR23, CR28, CR45 Diode	01295	Texas Instruments 1N752A	73293	Hughes 1N752A		
503458-009	CR41, CR42 Diode	04713	Motorola Semiconductor 1N965B	07263	Fairchild Semiconductor 1N965B		

Data Tech No	Description	Source 1		Source 2		Source 3	
		Code Ident	Mfg & Type	Code Ident	Mfg & Type	Code Ident	Mfg & Type
503582-005	CR48 Diode	04713	Motorola Semiconductor 1N4004	01295	Texas Instruments 1N4004	14433	ITT Semiconductor 1N4004
531986-014	R1 Res. 10.65M, 1%, 25ppm	03888	Pyrofilm Corporation PME70-T9-10.65 Meg ±1%				
503100-106	R2, R3, $10 Res. 10M, 1/4W, 5%	01121	Allen Bradley CB1065	09021	Airco Speer 4R106J		
531962-004	R4 Res. 1.85M, 1%, 25ppm	03888	Pyrofilm RN75E11853F		Electra/Midland		
532115-200	R5 (120k, 0.05%), R6 (12k, 0.05%), R7 (1.2k, 0.05%) Res. Set	14506	Data Technology 532115-200				
532112-014	R8, R12 Res. 200k, variable	07716	IRC Div. TRW, Inc. 750-308-200k	80294	Bourns 3299W-1-204		
531986-012	R9 Res. 11.75M, 50ppm, 1%	03888	Pyrofilm Corporation PME70-T2-11.75 Meg ±1%				
532112-009	R11, R32, R38 Res. 5k, variable	07716	IRC Div. TRW, Inc. 750-308-5k	80294	Bourns 3299W-1-502		
503100-333	R13, R14, R48, R49, R72, R73 Res. 33k, 1/4W, 5%	01121	Allen Bradley CB3335	09021	Airco Speer 4R333J		
*532118-001	R15 Res. 900Ω, 0.05%	07088	Kelvin EP20		Jordon J110		
*532118-002	R16 Res. 90Ω, 0.05%	07088	Kelvin EP20		Jordon J110		
*532118-003	R17 Res. 9Ω, 0.05%	07088	Kelvin EP20		Jordon J110		
*532118-004	R18 Res. 0.9Ω, 0.05%	07088	Kelvin EP21		Jordon J110		
*532118-005	R19 Res. 0.102Ω, 1%	07088	Kelvin 5074-P		Jordon F211		

*Resistor Set, Shunt unmatched

Data Tech No	Description	Source 1		Source 2		Source 3	
		Code Ident	Mfg & Type	Code Ident	Mfg & Type	Code Ident	Mfg & Type
531970-100	R20 Res. 10Ω, variable	73138	Beckman Instruments 72PMR10				
532000-020	R21 Res. 2.0Ω, 1/4W, 5%		R-Ohm Corporation R-25-2.0Ω-5%				
503100-999	R22, R76, Res.	01121	Allen Bradley Select in Test	09021	Airco Speer Select in Test		
503102-304	R23, R27 Res. 300k, 1W, 5%	01121	Allen Bradley GB3045	09021	Airco Speer SR1304J		
532046-001	R24 Res. 4k, 5W, 5%	07088	Kelvin KM350				
503100-304	R25, R35, R58, R83, R84 Res. 300k, 1/4W, 5%	01121	Allen Bradley CB3045	09021	Airco Speer 4R304J		
531854-336	R26 Res. 2.40k, 25ppm, 1%		Mepco RN55E2401E	19701	Electra/Midland RN55E2401E	91637	Dale RN55E2401E
503100-135	R28 Res. 1.3M, 1/4W, 5%	01121	Allen Bradley CB1355	09021	Airco Speer 4R135J		
532180-006	R29, R31 Res. 51.1k, 25ppm, 1%		Jordon Electric J110 Series				
532050-207	R30 Res. 1.4k, 1%	28363	Corning 1.40K				
532112-008	R46, R51, R56, R75 Res. 2k, variable	07716	IRC, Div. TRW, Inc. 750-308-2k	80294	Bourn 3299W-1-202	91637	Dale
531854-363	R33 Res. 15.4k, 25ppm, 1%		Mepco RN55E1542F	19701	Electra/Midland RN55E1542F	91637	Dale Electronics RN55E1542F
503683-009	R36 Res. 20k, 25ppm, 1%	07088	Kelvin EP20-20000-1%		Jordon J-11-20000-1%		
503683-014	R37 Res. 2.4k, WW, 1%	07088	Kelvin EP20-2400-1%		Jordon J-11-2400-1%		

Data 1orh No	Description	Source 1		Source 2		Source 3	
		Code Ident	Mfg & Type	Code Ident	Mfg & Type	Code Ident	Mfg & Type
[illegible]	R39, R86, R90, R91, R92, R93, R105 Res 7.5k, 1/4W, 5%	01121	Allen Bradley CB7525	09021	Airco Speer 4R752J		
531854-355	R40 Res. 30.1k, 25ppm, 1%		Mepco RN55E3012F	19701	Electra/Midland RN55E3012F		
532050-277	R41 Res. 7.5k, 1%	28363	Corning 7.5k				
532050-999	R42, R43, R66, R130, R138, R139, R140, R141, R142, R143, R144 Res.	28363	Corning Select in Test				
503100-162	R44, R59 Res. 1.6k, 1/4W, 5%	01121	Allen Bradley CB1625	09021	Airco Speer 4R162J		
532050-460	R45, R50 Res. 130k, 1%	28363	Corning 130k				
532112-008	R46, R51, R56, R75 Res. 2k, variable	28363	IRC Div. TRW, Inc. 750-308-2k	80294	Bourn 3299W-1-202		
530683-010	R47, R52 Res. 120k, 10ppm, 1%	07088	Kelvin EP20-120000-1%		Jordon J 11 120000-1%		
531866-001	R53 Res. 10Ω, variable	73138	Beckman 89PR10	80294	Bourn 3006P-1-100		
532046-005	R54 Res. 20k, 5W, 5%	07088	Kelvin KM500				
503100-103	R55, R131 Res. 10k, 1/4W, 5%	01121	Allen Bradley CB1035	09021	Airco Speer 4R103J		
532050-184	R57 Res. 806Ω, 25ppm, 1%	28363	Corning 806Ω				
532050-213	R60 Res. 1.62k, 50ppm, 1%	28363	Corning 1.62k				
503100-104	R61, R78, R79, R81, R98, R104, R95 Res. 100k, 1/4W, 5%	01121	Allen Bradley CB1045	09021	Airco Speer 4R104J		

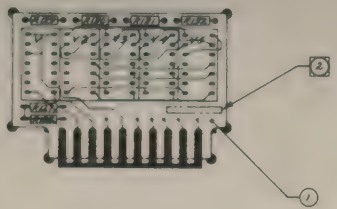
Data Tech No	Description	Source 1		Source 2		Source 3	
		Code Ident	Mfg & Type	Code Ident	Mfg & Type	Code Ident	Mfg & Type
503100-225	R62 Res. 2.2M, 1/4W, 5%	01121	Allen Bradley CB2255	09021	Airco Speer 4R225J		
503100-224	R63 Res. 220k, 1/4W, 5%	01121	Allen Bradley CB2245	09021	Airco Speer 4R224J		
503100-153	R65 Res. 15k, 1/4W, 5%	01121	Allen Bradley CB1535	09021	Airco Speer 4R153J		
503100-122	R67, R99 Res. 1.2k, 1/4W, 5%	01121	Allen Bradley CB1225	09021	Airco Speer 4R122J		
503100-182	R68 Res. 1.8k, 1/4W, 5%	01121	Allen Bradley CB1825	09021	Airco Speer 4R182J		
503100-361	R69 Res. 360Ω, 1/4W, 5%	01121	Allen Bradley CB3615	09021	Airco Speer 4R361J		
503100-472	R70 Res. 4.7k, 1/4W, 5%	01121	Allen Bradley CB4725	09021	Airco Speer 4R472J		
503100-821	R71 Res. 820Ω, 1/4W, 5%	01121	Allen Bradley CB8215	09021	Airco Speer 4R821J		
503100-154	R74 Res. 150k, 1/4W, 5%	01121	Allen Bradley CB1545	09021	Airco Speer 4R154J		
503100-473	R80, R82, R97, R101, R102, R103, R106, R107, R127, R128, R129, R34 Res. 47k, 1/4W, 5%	01121	Allen Bradley CB4735	09021	Airco Speer 4R473J		
503100-471	R85, R87 Res. 470k, 1/4W, 5%	01121	Allen Bradley CB4715	09021	Airco Speer 4R471J		
503100-302	R89, R94, R96, R125, R136 Res. 3.0k, 1/4W,	01121	Allen Bradley CB3025	09021	Airco Speer 4R302J		
503100-203	R108, R110, R112, R114 Res. 20k, 1/4W, 5%	01121	Allen Bradley CB2035	09021	Airco Speer 4R203J		

Data Tech No	Description	Source 1		Source 2		Source 3	
		Code Ident	Mfg & Type	Code Ident	Mfg & Type	Code Ident	Mfg & Type
503100-751	R109, R111, R113, R115 Res. 750Ω, 1/4W, 5%	01121	Allen Bradley CB7515	09021	Airco Speer 4R751J		
503100-202	R116, R77, Res. 2k, 1/4W, 5%	01121	Allen Bradley CB2025	09021	Airco Speer 4R202J		
503100-201	R117 Res. 200Ω, 1/4W, 5%	01121	Allen Bradley CB2015	09021	Airco Speer 4R201J		
503100-910	R118, R119, R120, R121, R122; R123, R124, Res. 91Ω, 1/4W, 5%	01121	Allen Bradley CB9105	09021	Airco Speer 4R910J		
503101-620	R132 Res. 62Ω, 1/2W, 5%	01121	Allen Bradley EB6205	09021	Airco Speer SR1/2620J		
503100-101	R133 Res. 100Ω, 1/4W, 5%	01121	Allen Bradley CB1015	09021	Airco Speer 4R101J		
503100-270	R134 Res. 27Ω, 1/4W, 5%	01121	Allen Bradley CB2705	09021	Airco Speer 4R270J		
530213-221	R135 Res. 220Ω, 1W, 5%	80294	Bourn 275-1-221				
818954-010	Q1, Q3, Q8, Q13, Q14, Q16, Q24, Q28, Q29 Transistor	32293	Intersil 2N5088				
531979-001	Q2 Transistor	32293	Intersil 2N3954				
531966-001	Q4, Q7, Q10, Q12, Q23, Q27 Transistor	04713	Motorola 2N5087	07263	Fairchild Semiconductor 2N5087		
532182-001	Q5 Transistor		Siliconix E108				
532178-001	Q6 Transistor	15818	Teledyne Semiconductor 2N5033-T0106				

Data Tech No	Description	Source 1		Source 2		Source 3	
		Code Ident	Mfg & Type	Code Ident	Mfg & Type	Code Ident	Mfg & Type
531785-001	Q9 Transistor		Almelco Semiconductor U1899E				
531979-003	Q11 Transistor	22229	Union Carbide 2N3958				
532071-001	Q17, Q18, Q19, Q20, Q26 Transistor	07263	Fairchild Semiconductor 2N5041				
530719-002	Q21, Q22 Transistor	07263	Fairchild Semiconductor 2N3643				
531765-001	Q25 Transistor	04713	Motorola Semiconductor MJE3055				
503067-017	F1 Fuse, 1 amp— 3AG	75915	Littlefuse 31200	71400	Bussman AGC-1		
531958-684	L1 Inductor	99800	Delevan Electronic Corp. 1025-88				
532113-001	T1 Transformer		PCA Electronics EP6539				
532036-015	SW1 Switch, Rotary (RANGE)		CTS Keene 212 T Bird Series				
532036-014	SW2 Switch, Rotary (FUNCTION)		CTS Keene 212T Bird Series				

Drawing No 548932 Ref

REVISIONS						
SYM	DESCRIPTION	ZONE	VER	DRAWN	CHECK	APPD	DATE
A	RELEASED PER E.O. 88910						



QTY REQD	PART OR IDENTIFYING NO	NOMENCLATURE OR DESCRIPTION	MATERIAL	CKT REF	ZONE	ITEM NO
				R129,130,131,132		7
2	603100-471	RESISTOR 470 Ω, 1/4W, 5%		R127, 128		6
						5
4	632117-001	DISPLAY		V2,3,4,5		4
1	632117-002	DISPLAY		V1		3
						2
1	548933-001	DISPLAY BOARD, MODEL 45				1
-200		LIST OF MATERIALS OR PARTS LIST				

548934

4. ALL DISPLAYS (V1 THRU V5) ON DISPLAY BOARD TO CARRY SAME BRIGHTNESS CODE. EXAMPLE: ALL A'S OR ALL B'S ETC

3. FOR TEST PROCEDURE SEE DRAWING 649122
FOR ENGINEERING SPEC SEE DRAWING 548909

2. IDENTIFY PART PER DATA TECHNOLOGY SPEC 600737

1. REFERENCE SCHEMATIC 548910

NOTES: UNLESS OTHERWISE SPECIFIED

UNLESS OTHERWISE SPECIFIED
TOLERANCES ON
DECIMALS ANGLES
XX ±.03 ±0°30
XXX ±.010
BREAK SHARP CORNERS OR MAX

DR Bch Y.K. Cooney 3-11-74
CHECK Paul Yeros
APPD W. Howard
APPD

DATA TECHNOLOGY CORPORATION
2700 SOUTH FAIRVIEW STREET, SANTA ANA, CALIFORNIA 92704

DISPLAY BOARD ASSY, MODEL 45

CODE IDENT NO	SIZE		
14506	C	548934	A
SCALE 2/1		SHEET 1 OF 1	

NEXT ASSY 548900

FORM NO. DTC 003

REPLACEABLE PARTS LIST

Model Model 45

Description Display Board Assembly

Data Tech No	Description	Source 1		Source 2		Source 3	
		Code Ident	Mfg & Type	Code Ident	Mfg & Type	Code Ident	Mfg & Type
503100-471	R127, R128 Res. 470Ω, 1/4W, 5%	01121	Allen Bradley CB4715	09021	Airco Speer 4R471J		
503100-101	R129, R130, R131, R132 Res. 100Ω, 1/4W, 5%	01121	Allen Bradley CB1015	09021	Airco Speer 4R101J		
532117-002	V1 Display						
532117-001	V2, V3, V4, V5 Display						

Drawing No 548934

COMPLETE AND AFFIX THIS CARD TO AN ASSEMBLY BEING RETURNED TO THE FACTORY.

Send it to:

DATA TECHNOLOGY CORPORATION, 2700 South Fairview Street, Santa Ana, California 92704
Attention: Product Service

Equipment:

Model _____ Serial Number _____ Purchase Date _____

Original P/O Number _____ Repair P/O Number _____

REASON FOR RETURN/MALFUNCTION SYMPTOMS _____

_____

_____

After repair, please return this unit to:

_____

_____

_____

Bill non-warranty repairs to:

_____

_____

_____

Non-warranty repairs authorized if not to exceed $_____.

Authorized by _____ Telephone No. (___) _____

This card provides a means of expanding communications between Data Technology and its customers Entries aid Data Technology in selecting programs which are consistant with customer requirements Your efforts are, therefore, very much sought and appreciated.

Name _____ Address _____

City _____ State _____ Zip Code _____

Model _____ Repeat Customer: Yes _____ No _____

Delivery: Good ____ Satisfactory ____ Poor ____ Manual: Good ____ Satisfactory ____ Poor ____

Appearance: Attractive ____ Needs Improvement ____

Who/What introduced Data Technology: Rep ____ Ad ____ Other ____

Additional features desired: _____

_____

Best liked features: _____

Application: _____

_____

Comments/Suggestions: _____

_____

_____

_____

Enclose with return equipment

Do not mail separately

FIRST CLASS
PERMIT NO. 4314
SANTA ANA, CALIF.
92704

BUSINESS REPLY MAIL

No Postage Necessary If Mailed In The United States

Postage will be paid by:

Data Technology Corporation
2700 South Fairview Avenue
Santa Ana, California 92704

Attention: Marketing Services

Printed in USA